

Storage component and Storage system

BACKGROUND OF THE INVENTION

1. Field of the Invention

5 The present invention relates to a storage system and a storage component, for recording various contents of video images, sounds, or the like.

2. Description of Related Art

 There has been a storage system in which a plurality
10 of home-oriented storage components are interconnected over a network to allow users to record various contents of video images, sounds, or the like, onto an arbitrary storage component on the network. This type of storage system, since it does not require a server for managing storage components
15 in a unified manner, is referred to as a server-less model and possesses several advantages such that the cost of constructing the system can be reduced.

 In the conventional storage system, however, there is no method of restricting storage capacity of each user. Hence
20 when a plurality of users use the storage system, problem arises that certain users fully occupy the storage components on the network and others fail to record contents.

 A system to solve the above problem is disclosed. The system is provided on a network with an apparatus for managing
25 in a unified manner, content recording information about contents recorded by users (see Japanese Patent laid-open No 2000-235546, Japanese Patent laid-open No 2001-313891 and Japanese Patent laid-open No 2001-325457, for example).

According to the systems disclosed in the above Patent Documents, a storage component on a network can restrict the storage capacity of each user by referring to the content recording information managed by the described apparatus in a unified manner when users record contents, which is an advantage of this system.

However, in the conventional arts disclosed in the above Patent Documents, an apparatus for managing the content recording information in a unified manner needs to be provided separately from the storage component, and such system is thus not the server-less model, leading to a problem of increase in cost of constructing the system.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a storage system with a configuration adapted to the server-less model which is capable of restricting storage capacity of each user.

Embodiments within the scope of the present invention may achieve one or more of the above objectives, in whole or in part.

According to one aspect of the present invention, a storage component connected to a network, comprises: a recording unit that records at least one content; a management table that has a first management item for managing, for each user, storage capacity in use by users in each of the recording unit of a plurality of storage components, and a second

management item for managing, for each user, total storage capacity that each user is allowed to use in all the recording unit of the plurality of storage components; and a control unit that restricts the storage capacity in use by the users
5 based on the management table so that the storage capacity of the recording unit used by a user does not exceed the total storage capacity that the user is allowed to use.

According to another aspect of the present invention, a storage system having a plurality of storage components
10 interconnected via a network, wherein each storage component comprises: a recording unit that records at least one content; a management table that has a first management item for managing, for each user, storage capacity in use by users in each of the recording unit of the plurality of storage components,
15 and a second management item for managing, for each user, total storage capacity that each user is allowed to use in all the recording unit of the plurality of storage components; and a control unit that restricts the storage capacity in use by the users based on the management table so that the
20 storage capacity of the recording unit used by a user does not exceed the total storage capacity that the user is allowed to use.

BRIEF DESCRIPTION OF THE DRAWINGS

25 For a better understanding of the invention as well as other objects and features thereof, reference is made to the following detailed description to be read in conjunction with the accompanying drawings,

wherein:

Figure 1 is a block diagram outlining a configuration of a storage system according to embodiments of the present invention;

5 Figure 2 is a block diagram showing a configuration of a storage component according to embodiments of the present invention;

Figure 3 is one example of a first management table shown in Figure 2; and

10 Figure 4 is one example of a second management table shown in Figure 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figure 1, a storage system according to
15 the one embodiment of the present invention comprises a plurality of storage components 1_1 to 1_N connected to one another via a network 2 such as a home network.

Each of the storage components 1_1 to 1_N includes a management table having a first management item for managing,
20 for each user, storage capacity in use by users in each of the storage components 1_1 to 1_N on the network 2; and a second management item for managing, for each user, the total storage capacity each user is allowed to use in all the storage components 1_1 to 1_N on the network 2, and on the basis of this
25 management table, restricts so that the storage capacity used by a user does not exceed the total storage capacity the user is allowed to use.

The management table in each of the storage components 1_1 to 1_N may be a single management table having the first management item and the second management item, or may alternatively be divided to a first management table having the first management item and a second management table having the second management item. This embodiment will be described assuming that the management table of each of the storage components 1_1 to 1_N is divided to the first management table having the first management item and the second management table having the second management item.

Each of the storage components 1_1 to 1_N is a storage unit for home use such as an HDD recorder, or a personal computer, to be provided at user's home, and they are assumed to be connected to one another over a home network such as Ethernet, while a configuration in which each of the storage components 1_1 to 1_N provided in an office is interconnected over an office LAN (Local Area Network), or a configuration in which each of the storage components 1_1 to 1_N provided at different sites is interconnected over the Internet, is also allowable.

Figure 2 is a block diagram showing one embodiment of a configuration of the storage components 1_1 to 1_N shown in Figure 1.

Referring to Figure 2, the storage components 1_1 to 1_N each comprises a communication processing unit 11, a content acquisition unit 12, a recording unit 13, the first management table 14, the second management unit 15, an input unit 16, and a control unit 17.

The communication processing unit 11 is an interface for transmitting and receiving packets describing various kinds of information to and from other storage components via the network 2.

5 The content acquisition unit 12 acquires various contents of video images, sounds, or the like. For example, it acquires program contents of terrestrial broadcasting or BS broadcasting via an antenna which is not shown or via a cable for cable television which is not shown either, and also
10 acquires contents from other storage components connected to the network 2 through the communication processing unit 11.

The recording unit 13 is an HDD and the like, for recording contents acquired by the content acquisition unit 12.

15 The first management table 14 is, as described above, a table representing, for each user, the storage capacity in use by users in each of the recording units 13 of the storage components 1_1 to 1_N on the network 2. In this first management table 14, the following items A to C are registered for each
20 of the storage components 1_1 to 1_N on the network 2, as shown in Figure 3.

(A) Storage capacity of the recording unit 13

(B) Storage capacity in use by each user A to X

(C) Time when data of item B was updated

25 The second management table 15 is, as described above, is a table representing, for each user, the total storage capacity each user is allowed to use in all the recording units 13 of the storage components 1_1 to 1_N on the network

2. In this second management table 15, the data of the following items D and E are registered for each user A to X, as shown in Figure 4, for example.

(D) Total storage capacity of recording units 13 each user
5 A to X is allowed to use

(E) Time when data of item D was updated

The input unit 16 is a part used by a user to input various kinds of information or instruction data onto the storage components 1_1 to 1_N . Note here that the input unit 16 includes
10 various portions associated with the input to the storage components 1_1 to 1_N , such as operation buttons provided to the storage components 1_1 to 1_N themselves and a receiving unit for receiving signals from a remote-controller.

The control unit 17 controls the above each component,
15 and more specifically, performs acquisition, creation, and management of the data of the first management table 14 and second management table 15, restriction on the storage capacity of each user on the basis of the first management table 14 and the second management table 15, and recording
20 of contents onto the recording unit 13.

Operation of the embodiment will be described in detail below.

Creation and management of the first management table 14 will be described.

25 When receiving, at the input unit 16 of the own storage, an instruction for recording or deleting contents into or from the recording unit 13 of the own or other storage component, the control unit 17 of each storage component 1_1

to 1_N recognizes a user that the recording instruction or deleting instruction is received from.

As a method of having the control unit 17 of each storage component 1_1 to 1_N recognize the user, there are, for example,
5 a method in which each user uses an individual remote-controller for the storage components 1_1 to 1_N , a method in which each user presses a relevant user recognition button on a remote-controller for the storage components 1_1 to 1_N , a method in which each user inputs an ID/Password to the storage
10 components 1_1 to 1_N , a method in which each user inputs his/her fingerprint to the storage components 1_1 to 1_N , and a method in which a user using the storage components 1_1 to 1_N is assumed to be a fixed user to have the control unit 17 uniquely recognize the user using the storage components 1_1 to 1_N .

15 When receiving, at the input unit 16 of the own storage component, the instruction from the user for deleting contents from the recording unit 13 of the own or other storage component, the control unit 17 of each storage component 1_1 to 1_N executes deleting processing. For example, when receiving the
20 instruction for deleting contents from the recording unit 13 of the own storage component, the control unit 17 executes the deleting processing and thereafter updates the data of the own storage component among data in the first management table 14 of the own storage component. More specifically,
25 regarding the own storage component among the data of the first management table 14, the storage capacity in use of each user is updated, and that time is also updated as data update time. Whereas, when receiving the instruction for

deleting contents from the recording unit 13 of another storage component, the control unit 17 transmits packets describing the user's instruction to another storage component concerned via the network 2 to prompt it to execute the deleting
5 processing.

Meanwhile, when receiving, at the input unit 16 of the own storage component, the instruction for recording new contents onto the recording unit 13 of the own or other storage component, the control unit 17 of each storage component 1_1
10 to 1_N determines based on the first management table 14 and the second management table 15 whether the storage capacity of the recording unit 13 used by the user exceeds the total storage capacity the user is allowed to use, as a result of recording the new contents, and only when it determines not
15 to exceed, the control unit 17 executes the recording processing. For example, when receiving the instruction from the user for recording contents onto the recording unit 13 of the own storage component, the control unit 17 executes the recording processing and thereafter updates the data of
20 the own storage component among the data in the first management table 14 of the own storage component. More specifically, regarding the own storage component among the data in the first management table 14, data of the storage capacity in use of each user is updated, and that time is also updated
25 as the data update time. When receiving the instruction of recording contents onto the recording unit 13 of another storage component, the control unit 17 transmits the packets describing the user's instruction to another storage

component concerned via the network 2 to prompt it to execute the recording processing.

The control unit 17 of each storage component 1_1 to 1_N transmits the packets describing the data in the first management table 14 of the own storage component, periodically and/or at predetermined timing (when the own storage component is activated or when the data of the first management table 14 is changed according to the change in the use status of the recording unit 13), by broadcasting into the network 2 or to multicast group addresses on the network 2 which are common to the storage components 1_1 to 1_N .

The information transmitted herein includes <1> data for identifying the own storage component (computer name or IP address), <2> data of the storage capacity in use of each user, and <3> data of the data update time of <2>. At this time, among the data of the first management table 14, only the data of the own storage component may be transmitted, or alternatively data of all the storage components registered in the first management table 14 may be transmitted.

The control unit 17 of each storage component 1_1 to 1_N updates, on the basis of the data in the first management table 14 of another storage component which is described in the packets received from another storage component concerned, data of the other storage component among the data in the own first management table 14.

For example, when only the data of the other storage component among data in the first management table 14 of the other storage component concerned is transmitted, the control

unit 17 of each storage component 1_1 to 1_N carries out the following processing.

When a new user who is not found in the own first management table 14 is registered in the data of the first management table 14 of other storage component, the control unit 17 of each storage component 1_1 to 1_N adds data of the storage capacity in use by the new user to the own first management table 14. When data of a user registered in the own first management table 14 is not found in the data of the first management table 14 of other storage component, the control unit 17 of each storage component 1_1 to 1_N deletes the data of the storage capacity in use by the user from the own first management table 14. When receiving packets from a storage component that is not registered in the own first management table 14, the control unit 17 adds data of the storage capacity in use of each user using the storage component to the own first management table 14. Also the control unit 17 recognizes the time of receiving the packets from the storage component as the data update time in relation to data of the other storage component, and updates the own first management table 14.

On the other hand, when the data of all the storage components registered in the first management table 14 of another storage component is transmitted, the control unit 17 of each storage component 1_1 to 1_N carries out the following processing.

The control unit 17 of each storage component 1_1 to 1_N compares the first management table 14 of the own storage component with the first management table 14 transmitted from

another storage component and specifies, among storage components (except for the own storage component) registered in the first management table 14 of the own storage component, a storage component having more latest data update time than the own storage component has. When a new user who is not found in the own first management table 14 is registered in the data of the first management table 14 of the specified storage component, the control unit 17 adds data of the storage capacity in use by the user to the own first management table 14. Furthermore, when user data represented in the own first management table 14 does not exist in the data of the first management table 14 of the specified storage component, the control unit 17 deletes the data of the storage capacity in use by the user from the own first management table 14. When the packets are received from a storage component that is not registered in the own first management table 14 or when a new storage component that is not registered in the own first management table 14 exists in the first management table 14 of other storage component, the control unit 17 adds data of the storage capacity in use of each user using the storage component to the own first management table 14. The control unit 17 also recognizes the time at which the data of the storage capacity in use of each user is actually updated, as the data update time of the data, and then updates the own first management table 14.

Furthermore, to cope with a storage component connected to the network 2 with its power being in an OFF-state (where the plug is not removed from a receptacle), the power can

be brought into an ON-state remotely over the network 2. A method of transmitting WOL (Wake On LAN) packets to a target storage component over the network 2, or the like, is given, for example. Specifically, control unit 17 of each storage component 1₁ to 1_N carries out the following processing.

The control unit 17 of each storage component 1₁ to 1_N periodically checks the data update time of other storage components in the own first management table 14.

When there is a storage component that a predetermined period of time has elapsed from the data update time, the control unit 17 of each storage component 1₁ to 1_N transmits WOL packets to the storage component via the network 2 in order to turn ON the power of the storage component. Each storage component 1₁ to 1_N repeats this transmission of the WOL packets a predetermined number of times so that they can certainly reach the storage component.

When the storage component which is a destination of the WOL packets is being connected to the network 2 and its power is in an OFF-state (where the plug is not removed from a receptacle), the storage component goes into a power ON-state by the WOL packets, therefore it subsequently becomes possible to receive the packets describing the data of the first management table 14 of the storage component.

On the contrary, when there is a storage component from which the packet describing the data of the first management table 14 cannot be received even after the predetermined period of time has elapsed from the WOL packet transmission, the control unit 17 of each storage component 1₁ to 1_N determines

that the storage component is separated from the network 2 and thus deletes the data of the storage component from the own first management table 14.

5 The above-described procedures allow each of the storage components 1_1 to 1_N to update the data of the own first management table 14 to the latest one and to substantially the same data among the storage components 1_1 to 1_N .

Creating/updating process of the second management table 15 will be described.

10 When receiving, at the input unit 16 of the own storage component, an instruction for registering the total storage capacity that a user is allowed to use, the control unit 17 of each storage component 1_1 to 1_N determines whether to admit the registration of the user, and only when it admits, makes
15 the user select the total storage capacity usable by the user within an extent not exceeding a recommended default value.

At this time, the control unit 17 of each storage component 1_1 to 1_N may estimate the upper limit number of users who can utilize this storage system to admit the user registration
20 only when the upper limit number of users is not exceeded, where the total storage capacity of all the recording units 13 on the network 2 may be divided by the upper limit number of users to set the divided storage capacity to the recommended default value. Or alternatively all users registrations may
25 be admitted, and of usable storage capacity that is not allocated to any user at this point, the storage capacity usable by users may be registered within an extent not exceeding the recommended default value. Note that in the latter case,

there is a possibility that the storage capacity allocatable to a user is 0 at that point. In this case, whenever available capacity is generated, the user may be given a priority in the allocation of the available capacity, and afterwards this
5 processing may be continued until the storage capacity allocated to the user reaches the user's requesting capacity.

After admitting the registration of the user and making the user select the total storage capacity that the user is allowed to use in all the recording units 13 on the network
10 2, the control unit 17 of each storage component 1_1 to 1_N recognizes the selected storage capacity as the total storage capacity usable by the user to thereby update the second management table 15, and then also recognizes that day and time as the data update time to thereby update the second
15 management table 15.

Upon receipt of an instruction for changing the total storage capacity that a user is allowed to use at the input unit 16 of the own storage component, the control unit 17 of each storage component 1_1 to 1_N makes the user select the
20 total storage capacity usable by the user within an extent not exceeding the recommended default value, and recognizes the selected storage capacity as the total storage capacity usable by the user to thereby update the second management table 15, and also recognizes that day and time as the data
25 update time to thereby update the second management table 15.

Furthermore, upon receipt of an instruction for deleting the total storage capacity that a user is allowed to use at

the input unit 16 of the own storage component, the control unit 17 of each storage 1_1 to 1_N deletes the user's data (the total storage capacity usable by the user and the data of update time data) from the second management table 15. In

5 this case, it is also allowable that the user's data cannot be deleted from the second management table 15 until the storage capacity used by the user becomes all 0, or alternatively that the user's data can be deleted from the second management table 15 even when the storage capacity used by the user still
10 remains. In the latter case, the remaining storage capacity may be considered to be subjected to immediate deletion or overwriting for effective use thereof, or may be maintained as it is.

The control unit 17 of each storage component 1_1 to 1_N
15 may not allocate the total storage capacity of all the recording units 13 on the network 2 as the total storage capacity usable by each user so that a part of the total storage capacity of all the recording units 13 may remain unoccupied. For example, when a user wishes to record program contents right
20 away immediately before a start of broadcasting or during the broadcasting, the above unoccupied part of the storage capacity is to be allocated, making it possible to cope flexibly with various situations.

The control unit 17 of each storage component 1_1 to 1_N
25 transmits packets describing data of the own second management table 15, periodically and/or at predetermined timing (when the own storage component is activated or when the data of the second management table is changed), by broadcasting into

the network 2 or to multicast grope addresses on the network 2 which are common to the storage components 1_1 to 1_N .

The data transmitted herein includes <1> data for identifying the own storage component (computer name or IP address), <2> data of the storage capacity that each user is allowed to use, and <3> data of the data update time of <2>.

The control unit 17 of each storage component 1_1 to 1_N updates, on the basis of the data in the second management table 15 of another storage component which is described in the packets received from another storage component concerned, data of a user whose usable total storage capacity is registered, modified, or deleted in other storage components, among the data of own second management table 15.

For example, the control unit 17 of each storage component specifies, among users registered in the own second management table 15, a user having more latest data update time compared to the second management table 15 of another storage component, and then updates data of the total storage capacity the specified user is allowed to use in the data of the own second management table 15 to the data in the second management table 15 of the other storage component. When a new user who is not found in the own second management table 15 is registered in the data of the second management table 15 of other storage component, the control unit 17 adds the data of the storage capacity that the user is allowed to use to the own second management table 15. The control unit 17 also recognizes the time at which the data of the storage

capacity the user is allowed to use is actually updated as the data update time for the user's data to thereby update the own second management table 15.

5 The above-described procedures allow each storage component l_1 to l_N to update the data in the own second management table 15 to the latest one and to substantially the same data among the storage components l_1 to l_N .

10 In the embodiments, the processing in the storage components l_1 to l_N is realized by the above-described dedicated hardware. In addition to that, a program for realizing this function may be recorded in a recording medium that is readable by each of the storage components l_1 to l_N , to thereby make them read the program recorded in this recording medium, and the processing may be consequently executed. The recording
15 medium readable by each of the storage components l_1 to l_N refers to a floppy disk, a magneto-optical disk, a transferable recording medium such as a CD-ROM, as well as the recording unit 13 such as an HDD built in each of the storage components l_1 to l_N . Furthermore, the recording medium readable by each
20 of the storage components l_1 to l_N includes those for dynamically storing a program for a short period of time in such a case as a program is transmitted via the network 2 (transmission medium or transmission wave), or those for storing a program for a predetermined period of time such
25 as volatile memory inside each of the storage components l_1 to l_N that serves as a server on that case.

According to the aforementioned embodiments, the user is restricted on the storage capacity even in the case of

using any storage component on the network 2, thus offering an advantage that contents can be recorded onto an arbitrary storage component on the network under the circumstance where the storage capacity is restricted.

5 Moreover, a server for managing a plurality of storage components in a unified manner does not need to be provided, therefore a system can be adapted to a configuration in the server-less model, providing an advantage of reducing the cost of constructing the system.

10 Although the invention has been described in connection with preferred embodiments thereof, it is to be understood that those embodiments are set forth solely to aid in understanding the invention, and should not be read in a sense to limit the scope of the invention. Modifications of the
15 techniques described herein will be apparent to the skilled artisan when practicing the invention, and such modifications are to be construed as falling within the scope of the appended claims.

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